

THE GEOLOGICAL SURVEY OF THE UNITED STATES.

THE twenty-first annual report of the United States Geological Survey is divided into seven parts. The first and sixth parts were received some time ago and were noticed in *NATURE* for December 26, 1901.

PART II.—General Geology, Economic Geology, Alaska.

There is an elaborate report on the geology of Rico Mountains in south-west Colorado, by Messrs. Whitman Cross and A. C. Spencer. The structure is that of a dome-like uplift of sedimentary and igneous rocks, out of which a compact group of peaks, rising above 12,000 feet, have been carved. The igneous rocks appear partly in the form of laccoliths, but the elevation is not in large degree due to the intruded masses.

Devonian and Carboniferous rocks occur in the centre of the uplift, with faulted masses of Algonkian quartzites and schists. The great "Red beds" of Colorado succeed; they are partly Permo-Carboniferous, but in the upper portion Triassic fossils have been found. Jura-Trias and Cretaceous rocks also occur, and igneous intrusions are found at various horizons throughout the series. Some notable landslides are described, and it is mentioned that, in recent geological times, the central mountain region suffered severe shocks, which shattered the rocks at the surface and to unknown depths. In consequence, landslides have occurred when other conditions were favourable.

A study of the glacial sculpture of the Bighorn Mountains of Wyoming, by Mr. F. E. Matthes, leads to the consideration of cirques. It is maintained that they have not been due to scour, but rather to a natural quarrying process, essentially the product of a "bergschund"—a crevasse or line of crevasses—which opens at a point between the moving névé and the quiescent névé, and is practically the upper limit of glacial motion. The author deals also with the effects of the occupation of valleys by névé, and introduces the term *nivation* to indicate its action as distinct from glaciation.

The Esmeralda formation in western Nevada, a freshwater-lake deposit, is described by Mr. H. W. Turner. It is of Middle Tertiary age, and contains fossil fishes and remains of ferns, fig, oak, willow, sumach, soap berry, and tree trunks 6 to 8 feet in diameter. It yields lignite, which may be of local value for stationary engines, house use, &c. The plants are described by Mr. F. H. Knowlton, and a new species of fossil fish, *Leuciscus turneri*, is named and figured by Mr. F. A. Lucas.

The origin of mineral veins at Boulder Hot Springs in Nevada is discussed by Mr. W. H. Weed. The veins have no special economic value, yielding but small quantities of gold, silver, copper, &c., but they are regarded as true mineral veins and as due to deposition from hot water. The Boulder Hot Springs are probably deep seated and connected with rhyolitic intrusions which formed the latest manifestation of volcanic activity in the region. It is believed that the gold is derived from granite into which the rhyolitic rocks were intruded.

The Eastern Choctaw coal-field is described by Messrs. J. A. Taff and G. I. Adams. It is of Upper Carboniferous age and forms part of the Indian territory, connecting the coal-fields of Arkansas with those of Kansas, Missouri and Iowa. It yields good bituminous coal. The Camden coal-field of south-western Arkansas is reported on by Mr. Taff. This is of Eocene age, and it yields a lignite which as a gas producer is said to be inferior only to the best cannel coals.

Reconnaissances in Alaska are reported on separately by Messrs. A. H. Brooks, O. Rohn and F. C. Shrader. These reports will be serviceable to future travellers and prospectors, as, in addition to geological and mineralogical notes, there are observations on the climate, timber, game, natives, &c. A useful list and explanation of Alaskan geographical names is contributed by Mr. Marcus Baker.

PART III.—General Geology, Ore and Phosphate Deposits, Philippines.

Mr. W. H. Hobbs contributes a memoir on the Newark (Triassic) system of the Pomperaug valley, Connecticut. The greater portions of the clastic rocks are reddish-brown sandstones and shales the constituents of which are mainly quartz, feldspar and mica; they are, in fact, arkoses, composed of the débris of granite and gneiss. The associated igneous rocks are contemporaneous intrusions of lava, and attention is called to

the production of secondary enlargement of quartz grains in a shale-conglomerate at its contact with an overlying sheet of basalt. The geological structure of the area is considered in detail. Vertical or nearly vertical joint-planes have developed in great numbers within the area, and an attempt is made to determine the nature of the faults along the joints and the manner in which the area as a whole has been deformed through the depression of the orographic blocks which the joints have conditioned. Compression of the area in a nearly east-west direction is believed to have found relief in the prevailing dislocations. The drainage-system of the area is finally considered, and it is found that the streams have been directed in their courses to correspond with the direction of the prevailing fault-series. The work of ice is also briefly discussed. Mr. F. H. Knowlton reports on the silicified wood from the Newark formation.

The laccoliths of the Black Hills in South Dakota and Wyoming are described by Mr. T. A. Jaggar, jun. It is shown that igneous intrusions of rhyolite and phonolite accompanied or immediately followed a great uplift in the area. This uplift arched the horizontal strata of the plains into an elongated dome, while schists beneath moved up irregularly on nearly vertical plains of schistosity. The igneous matter arose through the steeply inclined schists and spread out among the sediments which lay unconformably across the older rocks. The intrusion is regarded rather as an effect than as a cause of the great uplift. Mr. Ernest Howe describes a number of experiments undertaken to imitate the processes involved in the formation of laccoliths. These prove that low viscosity favours wide lateral extension to form sills; high viscosity produces thick lenticular bodies. Moreover, the intrusive material thickens into domes where a resistant overlying stratum locally thins. A stratigraphical obstacle may also cause a sill to thicken into a laccolith.

The iron-ore deposits of the Lake Superior region are further treated of by Mr. C. R. Van Hise. He points out that the region is the most important in the world for the production of the metal. In 1900, it yielded more iron than the maximum product of Great Britain. He, however, mentions that the exhaustion of the high-grade ores of Lake Superior within a few decades is little short of a certainty. He therefore urges that the material in which the percentage of iron is below the present market demand and which must be handled during present operations should be stock piled. The iron-bearing formations are the Archæan, Lower and Upper Huronian. The ores originated from cherty iron-bearing carbonate, and to some extent the ore bodies are due to the oxidation of the iron carbonate in place; but they are mainly to be attributed to the secondary enrichment by downward percolating waters below crests or slopes, where such waters were converged by the pitching troughs in the strata.

The Arkansas bauxite deposits are described by Mr. C. W. Hayes. At present, this mineral has been discovered in commercial quantities in only three areas in the United States. The Arkansas bauxite occurs in the Fourche Mountain district and in Bryant Township. At Bryant, it rests on kaolinised syenite and has a thickness of 10 or 15 feet, and in some places possibly 40 feet. While largely a chemical precipitate, it has some features of an ordinary detrital sediment. Some of it is pisolitic, while the whole is of this character in the Fourche Mountain district. The deposits are considered to have been due to the action of heated alkaline waters on the syenite, and to subsequent superficial chemical reactions on the deposits left by the springs.

The Tennessee white phosphate is also described by Mr. Hayes. Much of it appears to have been formed by deposition from solution in cavities of limestone.

Mr. G. F. Becher's report on the geology of the Philippine Islands has previously been noticed, a reprint in advance having been received.

PART IV.—Hydrography.

This volume contains an elaborate report on the progress of stream measurements for the year 1899, by Mr. F. H. Newell. There is also a preliminary description of the geology and water resources of the southern half of the Black Hills and adjoining regions in South Dakota and Wyoming, by Mr. N. H. Darton. More precise and comprehensive knowledge of the artesian waters in the Dakota sandstone and other widely distributed water-bearing rocks rendered necessary a detailed study of the area. Cambrian, Carboniferous, Jura-Trias, Cretaceous, Tertiary

and Pleistocene strata are described, with especial reference to underground and surface waters, soils and mineral resources. Cretaceous coal, also gypsum, petroleum, fuller's earth in Tertiary strata, and other economic products are noted.

A report on the High Plains and their utilisation is contributed by Mr. W. D. Johnson. This region lies on the borders of Colorado, Kansas, New Mexico and Texas, and it corresponds approximately to what is sometimes called the Central Plains region. In the broad sense, it is a plain; in reality, it is a surface of degradation with topographic diversity. There is practically no drainage, the local precipitation being absorbed. The question of utilisation must depend on wells. The author deals fully with the origin and capabilities of the area, but his report has been left incomplete.

PART V.—*Forest Reserves.*

This volume, with accompanying atlas, deals exhaustively with timber regions.

PART VII.—*Texas.*

This contains an account of the geography and geology of the Black and Grand Prairies, Texas, with detailed descriptions of the Cretaceous formations and special reference to artesian waters, by Mr. R. T. Hill.

Pre-Cambrian schists, granites and crystalline limestones, and a series of Palæozoic and Permo-Triassic rocks form the floor of this region, and above are Cretaceous formations which are by far the most important in area and economic value. Their texture and stratigraphic arrangement conduce to the transmission or retention of underground waters in extensive and prolific artesian well-systems. They yield the most valuable soil, building material, cement, and some oil-fields. These Cretaceous strata are therefore described in considerable detail, and numerous plates of fossils are given. Various superficial deposits are likewise described.

We have received several series of *Bulletins* of the United States Geological Survey.

Series A. *Economic Geology*.—No. 180 is on the occurrence and distribution of corundum, by Mr. J. H. Pratt. The localities for corundum in the United States, with the exception of those in Montana, Colorado and California, are limited to the Appalachian region, and the mining has been confined to Georgia and North Carolina, and to the emery mines at Chester, Mass. The author includes, not only the ordinary translucent to opaque varieties of corundum, but also the sapphires and emery, which is a mechanical admixture of corundum, magnetite and hæmatite. He deals very fully with the uses and distribution of the minerals.

No. 182 is a report on the economic geology of the Silverton Quadrangle, Colorado, by Mr. F. L. Ransome. Gold, silver, copper and lead have been obtained, and it is probable that zinc ores may be worked. Fissures carrying variable amounts of ore occur in all the rocks of the area, from the Algonkian schists to the later monzonitic intrusions that cut the Tertiary volcanic series. By far the greater number are found in the volcanic rocks of the San Juan series (andesitic breccias) and of the Silverton series (massive andesite, rhyolitic and other breccias), both of Tertiary age. Detailed descriptions of the mines and of special areas are given, and the origin of the lodes is discussed.

No. 184, on the oil and gas fields of the Western Interior and Northern Texas Coal-measures, and of the Upper Cretaceous and Tertiary of the Western Gulf Coast, is by Mr. G. I. Adams. The shales of the Coal-measures are very bituminous and give evidence of the presence of organic matter in great abundance at the time of their deposition. The burying of this material and its subsequent decomposition gave rise to the oil and gas. The reservoirs are usually sandstones which vary in porosity, while the shales serve to seal in the oil and gas. The oil which occurs in the Cretaceous and Tertiary strata is associated with sulphur, gypsum and rock salt. Mendeléeff's theory, that petroleum is formed by the action of heated water on carbide of iron, is briefly discussed. Particulars are given of the production of oil and gas in different localities.

No. 193, geological relations and distribution of platinum and associated metals, by Mr. J. F. Kemp. This gives a general account of these metals, and of their mode of occurrence and distribution. It is concluded that platinum is very sparsely distributed in its mother rock. It has been mostly derived from

peridotites, and the chances of finding it in quantities sufficient to mine are small.

No. 178 (not included in the economic series) deals with the El Paso tin deposits in Texas. The ores comprise abundant cassiterite and wolframite in a quartz gangue, and the veins exhibit characters similar to those of Cornwall.

Series E. *Chemistry and Physics*.—No. 186, on pyrite and marcasite, by Mr. H. N. Stokes. The author points out that much uncertainty exists in distinguishing these minerals by the usual methods. Specimens crystallising in the regular system are true pyrite, while those forming rhombic crystals are marcasite.

Series F. *Geography*.—Comprises Nos. 181, 185 and 194, which deal with the results of primary triangulation, of spirit levelling and observations on the north-west boundary of Texas. Nos. 183, 187, 190 and 192 are gazetteers of Porto Rico, Alaska, Texas and Cuba.

Series G. *Miscellaneous*.—Comprises No. 188, bibliography of North American geology, &c., for 1892–1900, inclusive, and No. 189, index to the same. These will prove of great value for reference. With them we may include No. 179, a bibliography and catalogue of the fossil vertebrata of North America, and No. 177, catalogue and index of the publications of the United States Geological Survey, 1880–1901.

Monograph vol. xli. of the United States Geological Survey (1902) contains an essay on the Glacial formations and drainage features of the Erie and Ohio basins, by Mr. Frank Leverett. He describes in some detail the drift deposits which extend over a large area southwards from those lake-basins to the vicinity of the Allegheny and Ohio rivers. The soils, peat-beds and weathered zones which mark intermediate stages in the glaciation; the lakes which were formed in front of the retreating ice; and, generally, the past and present systems of drainage are discussed and explained.

A separate volume on the mineral resources of the United States for the year 1900, by Mr. David T. Day, is the seventeenth annual report on this subject issued by the United States Geological Survey. It shows a continuation of the remarkable activity in the mineral industries of the country. While coal and iron are the most important products, copper, lead, gold and manganese ores show an increase, as do petroleum, natural gas, stone, clays and other materials. The production of quick-silver, antimony and nickel, of phosphate rock, bauxite and fuller's earth has decreased.

We have, further, received the fourth volume issued by the Maryland Geological Survey, a work, as usual, sumptuously printed and illustrated. Mr. Bailey Willis contributes an essay on the history of Maryland during Palæozoic time. He gives an account of the growth and wasting of several mountain systems, the expansion of great plains and their submergence, and of the folding and dislocation of the strata. He concludes with a brief account of the influence of the older history on the later geological changes.

Other portions of this volume deal with the economic geology, the highways and tests of road-materials, and there is an important report on the clays of Maryland, by Mr. Heinrich Ries, the leading clay expert in the country. He discusses the properties of clay, chemical and physical, and shows how their bad qualities can be offset by the addition of proper ingredients. There is also a full account of the principal clay deposits of the State. A great variety of clays is found, but at present no fuller's earth. The essay may be profitably studied by all interested in clay-deposits.

ANTHROPOLOGY: ITS POSITION AND NEEDS.¹

THE practical difficulty of drawing a dividing line between the legitimate scope of anthropology and that of other studies is so great that we are often told there is no science of anthropology. This absence of definiteness adds a charm to the subject and is fertile in the production of new ideas, for it is at the fringe of a science that originality has its greatest scope. It is only by a synthesis of the various studies which are grouped together under the term anthropology that one can hope to gain a clear conception of what man is and what he has done. After giving

¹ Abstract of an address to the Anthropological Institute by the retiring president, Dr. A. C. Haddon, F.R.S., January 26.